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REVIEW of Application of Expert Systems in the Medicine

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***Abstract*— Knowledge base expert system is software that represents the knowledge. There are certain criteria of expert system which includes Rule-based expert system, Frame-based systems, Hybrid systems, Model-based systems, Real-time systems. IN medicine Rule-based expert system is used from 1970. Historical development of Knowledge base expert system in medicine includes system such as AAPHelp, INTERNIST I, MYCIN, CASNET/Glaucoma , PIP , ABEL, ONCOCIN, DXplain, QMR :Quick Medical Reference,.**

***Index Terms*—knowledge based System, criteria of expert system, AAPHelp, INTERNIST I, MYCIN, CASNET**

I. INTRODUCTION

Data, information, knowledge and wisdom are major elements of human thinking and reasoning process. Data concern with observation and raw facts. The processed data is known as information. Knowledge is a result of processes like creation, filtration, comparison and analysis of available information to generate meaningful outcome. The experience, judgment, values, laws etc. are to be added to have the wisdom. Development of systems that make use of knowledge, wisdom and intelligence is a step towards meeting this challenge.

An expert system is a computer program that attempts to copy human experts by the system's capability to give advice, to teach and execute intelligent tasks. Major components of an expert system are

- Knowledge base--the software that represents the knowledge.
- Inference engine--the reasoning mechanism.
- User interface--the hardware and software that provide the dialogue between people and the computer.
- Domain expert--the individual who is considered an expert.
- Knowledge engineer--the individual who acquires and represents the knowledge.
- Explanation facility--the software that answers questions such as "Why" and “How."
- Blackboard--a workplace for storing and working on intermediate information.
- Reasoning improvement--a facility (not available commercially) for improving the reasoning capabilities of an ES.
- User--the non-expert who uses the machine for consultation.
- Hardware--the hardware that is needed to support the Expert System..

Genetic categories of ES applications are:

- Rule-based expert system - Knowledge is represented by a series of rules.
- Frame-based systems - Knowledge is represented as a series of frames (an object-oriented approach).
- Hybrid systems - Involve several approaches such as fuzzy logic and neural networks.
- Model-based systems - Structured around a model that simulates the structure and function of the system under study.
- Ready-made systems - Utilize prepackaged software.
- Real-time systems - Systems designed to produce a just-in-time response

II. REVIEW OF APPLICATION OF EXPERT SYSTEMS IN THE MEDICINE

I. AAPHELP

AAPHelp: de Dombal's system for acute abdominal pain (1972) an early attempt is to implement automated reasoning under uncertainty. De Dombal's system, developed at Leeds University, was designed to support the diagnosis of acute abdominal pain, based on analysis, and need for surgery. The system's decision making was based on the naive Bayesian approach.

II. INTERNIST I (1974)

Pople and Myers work on INTERNIST, one of the first clinical decision support systems, designed to support diagnosis, in 1970. INTERNIST-I was a rule-based expert system designed at the University of Pittsburgh in 1974 for the diagnosis of complex diagnosis problems in general internal medicine. It uses patient observations to deduce a list of compatible state of disease (based on a tree-structured database that links diseases with symptoms). By the early 1980s, it was recognized that the most valuable product of the system was its base of medical knowledge base. This was used as a basis for successor systems including CADUCEUS and Quick Medical Reference (QMR), a commercialized diagnostic DSS for internists.

III. MYCIN (1976)

MYCIN was a rule-based expert system designed to diagnose and recommend treatment for certain blood infections (antimicrobial selection for patients with bacteremia or meningitis). It was later extended to handle other infectious

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diseases. Clinical knowledge in MYCIN is represented as a set of IF-THEN rules with certainty factors attached to diagnoses. It was a goal-directed system, using a basic backward chaining reasoning strategy (resulting in exhaustive depth-first search of the rules base for relevant rules though with additional heuristic support to control the search for a proposed solution). MYCIN was developed in the mid-1970s by Ted Shortliffe and colleagues at Stanford University. It is probably the most famous early expert system, described by Mark Musen as being "the first convincing demonstration of the power of the rule-based approach in the development of robust clinical decision-support systems"

The EMYCIN (Essential MYCIN) expert system shell, employing MYCIN's control structures was developed at Stanford in 1980. This domain-independent framework was used to build diagnostic rule-based expert systems such as PUFF, a system designed to interpret pulmonary function tests for patients with lung disease.

IV. CASNET/GLAUCOMA

CASNET (Causal ASsociational NETworks), developed in the 1960s, was a general tool for building expert system for the diagnosis and treatment of diseases. The most significant Expert System application based on CASNET was CASNET/Glaucoma for the diagnosis and treatment of glaucoma. CASNET/Glaucoma was developed at Rutgers University and implemented in FORTRAN.

A CASNET model is considered to be an appropriate vehicle for representing knowledge in areas such as glaucoma, where the causal model of disease is well understood . The CASNET model is a particular type of semantic net, a knowledge structure consisting of "nodes to represent the concepts, events, characteristics, and values of interest in a system, as well as branches specifying the relationships between nodes". In the CASNET approach, three levels of description such as observation, pathophysiological state, and disease category-are used to formulate recommendations for treatment.

V. PIP

PIP, the Present Illness Program, was a system built by MIT and Tufts-New England Medical Center in the 1970s that gathered data and generated hypotheses about disease processes in patients with renal disease.

VI. ABEL

Acid-Base and ELectrolyte program. An expert system, employing causal reasoning, for the management of electrolyte and acid base derangements. Developed at the Laboratory for Computer Science, MIT, in the early 1980s.

VII. ONCOCIN

A rule-based medical expert system for oncology protocol management developed at Stanford University. Oncocin was designed to assist physicians with the treatment of cancer patients receiving chemotherapy. ONCOCIN was one of the first DSS which attempted to model decisions and sequencing actions over time, using a customised flowchart language. It extended the skeletal-planning technique to an application area where the history of past events and the duration of actions are important.

VIII. DXPLAIN

"DXplain is a decision support system which uses a set of clinical findings (signs, symptoms, laboratory data) to produce a ranked list of diagnoses which might explain (or be associated with) the clinical manifestations. DXplain provides justification for why each of these diseases might be considered, suggests what further clinical information would be useful to collect for each disease, and lists what clinical manifestations, if any, would be unusual or atypical for each of the specific diseases" DXplain includes 2,200 diseases and 5,000 symptoms in its knowledge base. Developed by Laboratory of Computer Science, Massachusetts General Hospital, Harvard Medical School.

DXplain, available through the American Medical Association's AMAnet (AMAnet is a registered trademark of the American Medical Association.), suggests reasonable diagnoses that should be considered given a particular set of symptoms. All these systems assume a far less active role than was envisioned for PIP or ONCOCIN, but if they are actually used by practicing physicians, in the long run they may have a far greater impact than more ambitious efforts to date.

IX. QMR: QUICK MEDICAL REFERENCE

QMR is a diagnostic decision-support system with a knowledge base of diseases, diagnoses, findings, disease associations and lab information. It includes information from the primary medical literature, on almost 700 diseases and more than 5,000 symptoms, signs, and labs. QMR was designed for 3 types of use:1) as an electronic textbook 2) as an intermediate level spreadsheet for the combination and exploration of simple diagnostic concepts and 3) as an expert consultant program. Developed (1980) by the University of Pittsburgh and First Databank, California.

From technical point of view Knowledge-based systems has not been as successful as expected, in their role of providing expert advise to health professional. Miller's QMR is a modification of INTERNIST, the aim of which is "to meet the practical needs of clinical medicine". QMR is implemented using an IBM compatible PC/AT and can function at varying levels of sophistication, as already mentioned. P. L. Miller has developed a system, ESSENTIAL-ATTENDING, that critiques a plan for patient care, rather than advising the user as to what to do. Yet another system, RECONSIDER, provides a list of differential diagnoses for a physician's consideration [97]. It is one of the few programs that has undergone a comparative evaluation with similar systems (PIP and INTERNIST). RECONSIDER is based on the potential of the "library" function of the computer-that is to say, its capacity to remind the user not to forget a particular possibility, much akin to the premise behind CARE, COSTAR, and HELP.

III. Conclusions

Despite many problems and lack of success in the sense of routine use, research in knowledge bases has added immeasurably in understanding of the user interface and of knowledge structure and use. Perhaps the greatest contribution of knowledge-base development has been its role in codifying knowledge and encouraging the development of models of the medical decision-making process.

Evaluation studies of such widely available knowledge bases and knowledge-based systems as PIP, and DXplain are needed to determine, if these types of knowledge systems do, in fact, make a difference in patient care. Ideally, this flurry of activity should result in a greater variety of approaches to knowledge representation and access. Clearly, given the difficulties of knowledge-base creation and maintenance, wide-scale implementation and use will be necessary if knowledge bases are to meet the goals of "effective use and interaction" envisioned by Goldstein and Papert

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